## REMARKS

Claims 1-6, 9-11, 14, 15, 24, 26-73, and 75-85 are pending in the application, of which claims 1, 9, 10, 11, 14, 24, 26-28, 31, 33-35, 37, 39, 48, 49, 54, 62, 64, 65, 72, and 73 are being amended, and claims 79-85 are being added. Claims 8 and 63 are being canceled without prejudice or disclaimer.

Applicant requests entry of the claim amendments, added claims, and Specification amendments, which are fully supported by the Specification and original claims and add no new matter. For example, the amendment to claim 9 is supported at least by the drawings of Figures 2, 3a and 3b that show the inlet facing the outlet, and the Specification at page 2, lines 4 to 30, which describes an inlet and outlet of a prior art exhaust tube.

Added claim 79 is supported at, for example, page 11, lines 11-15, of the Specification, as well as Figure 2 showing a straight exhaust tube, of which substantially the entire internal flow surface is parallel to a single direction of the flow of the effluent through the exhaust tube.

Added claim 80 and the amendment to the Specification are supported at, for example, page 2, lines 21-23, of the Specification and Figure 1 (Prior Art), which discuss an offset inlet and outlet, and Figure 2, which shows an inlet and outlet that are substantially facing each other in an opposing relationship.

Added claims 81-85 are supported in, for example, previous claim 11.

Dependent claims 8 and 63 are being canceled to avoid repetitiveness of language between themselves and the independent claims from which they depend.

Reconsideration of the present case in view of the amendments and remarks herein is earnestly requested.

**Objection to the Drawings under 37 C.F.R. 1.83(a)**

The Examiner objected to the drawings under 37 C.F.R. 1.83(a), stating that "the drawings must show every feature of the invention specific in the claims" and that "the exhaust tube's 'distributor plate' must be shown or the feature canceled from the claims." Claim 9, the only claim reciting the exhaust tube's "distributor plate," is being amended, so this objection is now obviated.

**Objection to Claim 39**

The Examiner objected to claim 39 as depending from a deleted claim. Claim 39 is being amended to change its claim dependence, and this objection is also now believed to be obviated.

**Section 112 Rejection of Claims 9 and 39**

The Examiner rejected claim 9 under 35 U.S.C. 112, first paragraph, alleging that "the exhaust tube's 'distributor plate' is not described in the specification to enable one or ordinary skill in the art to make and/or use the invention." Claim 9 is being amended to remove the "distributor plate" language.

The Examiner also rejected claim 39 under 35 U.S.C. 112, second paragraph, for being dependent from a cancelled claim. Claim 39 is being amended to change its dependence.

Thus, the Section 112 rejections of claims 9 and 39 are now believed to be obviated.

<u>**103(a) Rejection of Claims 1, 6, 24, 31, 35, 56, 59-61, 74, and 77**</u>

**The Examiner rejected claims 1, 6, 24, 31, 35, 56, 59-61, 74, and 77 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,453,125 to Krogh in view of U.S. Patent No. 5,567,243 to Foster et al. This rejection is respectfully traversed.**

<u>Claim 1</u>

Claim 1, as amended, is allowable over Krogh because Krogh fails to teach "an exhaust tube through which the effluent may be flowed, the exhaust tube being adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, and (ii) that cause turbulence in the flow of the effluent through the exhaust tube."

The Examiner states that the inlet port (7), plasma source (1), and exit port (8) of Krogh is the same as the claimed "exhaust tube." (page 4, item (vi) of the latest Office Action). However, the inlet port (7), plasma source (1), and exit port (8) are not the same because these structures are joined such that right angled recesses are present in the structure. For example, as shown in Figure 2, the diameter through which the effluent passes changes instantly at the right-angle junction between the inlet port (7) and the plasma source (1), perturbing the flow of the effluent. The wall that drops down to form the base portion of the plasma source (1) is a square-shaped recess between the inlet port (7) and the exit port (8).

Furthermore, the plasma source of Krogh is also substantially square-shaped with square corners, as shown in Figure 1. These square corners are recesses that alter the flow direction of the effluent to provide a circuitous flow. This structure has been discussed and distinguished in the Background of the instant application, which states: "another problem with the conventional abatement chamber (12) is its square shape which includes corners and recesses that result in stagnant regions in

which gas phase nucleations produce solid phase byproducts that deposit on the internal surfaces of the abatement chamber (12)." (Page 3, lines 1-8.) In contrast, the exhaust tube of claim 1 is "adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent projections or recesses ..."

Moreover, neither Krogh nor Foster et al. teaches "an exhaust tube through which the effluent may be flowed, ... the exhaust tube being adapted to provide <u>a non-circuitous and non-turbulent flow</u> of effluent therethrough by being substantially absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, and (ii) that cause turbulence in the flow of the effluent through the exhaust tube." (Emphasis added.) Krogh's square shaped recesses result in turbulence in the flow of effluent from the inlet port (7) to the exit port (8) as the effluent falls into the recessed area and then climbs out of it to reach the exit port (8).

Instead, Foster et al. teaches that reaction products "might be removed through the appropriate exhaust port (32)" shown in Figure 1. However, Foster et al. is silent regarding the inner shape of the exhaust port (32), such as whether the exhaust port is substantially absent projections or recesses.

Additionally, Foster et al. fails to teach "an RF energy applicator to couple RF energy to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent," as recited in claim 1.

<u>Claim 24</u>

Claim 24, as amended, is also allowable over Krogh because Krogh does not teach "a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level." Instead, Krogh is silent on the matter of a computer controller system.

Foster et al. also fails to teach "a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level." Rather, Foster et al. is silent on the matter of any computer controller system.

Thus, claims 1 and 24, and the claims dependent therefrom, including claims 6, 31, 35, 56, 59-61, 74, and 77, are allowable over Krogh in view of Foster et al.

**<u>103(a) Rejection of Claims 10, 11, 15, 26, 27, 28, 29, 30, 33, 40, 43-46, 49-54, 66, 69-71, 75, 76, and 78</u>**

**The Examiner rejected claims 10, 11, 15, 26, 27, 28, 29, 30, 33, 40, 43-46, 49-54, 66, 69-71, 75, 76, and 78 under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,352,902 to Aoki in view of Krogh. This rejection is respectfully traversed.**

<u>Claims 10 and 11</u>

Claims 10 and 11 are allowable over Aoki because Aoki fails to teach, inter alia, "a computer controller system comprising program code capable of monitoring the signal from the gas analyzer" and "determining whether the hazardous gas content of the effluent exceeds a safety level."

Instead, Aoki teaches substrate etching and a "control/computation unit 53 [that] ... outputs a control signal for ending the etching" at an endpoint. (Col. 7, lines 30-32.) A unit that detects conditions indicative of an endpoint and ends the etching process is not the same as a safety operational program code that determines whether the hazardous gas content of the effluent exceeds a safety level." There is no mention of code to measure the hazardous gas content, nor mention of code to determine whether the hazardous gas content exceeds a safety level.

Krogh does not make up for the deficiencies of Aoki because Krogh also fails to teach a "computer controller system capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level." Instead, Krogh is silent on the matter of a computer controller system.

Furthermore, the Examiner acknowledges in section (ii) on page 7 of the latest Office Action that Krogh does not teach a computer controller system capable of performing at least one of the actions (i), (ii), or (iii) in response a determination that the hazardous gas content of the effluent exceeds a safety level, as recited in claims 10 and 11. Krogh also does not teach performing either of the actions (iv) or (v) recited in claims 10 and 11.

<u>Claim 26</u>

Claim 26 is also allowable over Aoki because Aoki does not teach, inter alia, "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content of the effluent is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber."

A control/computation unit that detects conditions indicative of an endpoint and ends the etching process, as taught in Aoki, is different from a computer controller system comprising program code that determines whether the hazardous gas content of the effluent exceeds a safety level and performs at least one of the actions (i) through (v) recited above.

Krogh does not make up for the deficiencies of Aoki because Krogh also fails to teach the computer controller system recited in claim 26. The Examiner acknowledges that Krogh does not teach a computer controller system capable of performing at least one of the actions (i), (ii), or (iii) recited in claim 26. Krogh also does not teach a computer controller system capable of performing either of the actions (iv) or (v) recited in claim 26. Rather, Krogh is silent on the matter of a computer controller system.

<u>Claim 28</u>

Claim 28 is also allowable over Aoki because Aoki fails to teach "a computer program product comprising computer readable program code, the computer readable program code comprising "safety operational program code that upon receiving a signal that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber."

A control/computation unit that detects conditions indicative of an endpoint and ends the etching process, as disclosed in Aoki, is different from a computer program product comprising safety operational program code that detects when the hazardous gas content of the effluent exceeds a safety level, and performs at least one of the actions (1) through (4) recited above.

Krogh does not make up for the deficiencies of Aoki because Krogh also fails to teach the computer program product recited in claim 28. Krogh is silent on the matter of a computer program product.

Thus, claims 10, 11, 26, and 28, and the claims dependent therefrom, including claims 15, 27, 29, 30, 33, 40, 43-46, 49-54, 66, 69-71, 75, 76, and 78, are allowable over Aoki in view of Krogh.

**<u>103(a) Rejections of Claims 11, 15, 26, 27, 28, 29, 30, 33, 37, 38, 50-54, 64-66, 69-71, 76, and 78</u>**

**The Examiner rejected claims 11, 15, 26, 27, 28, 29, 30, 33, 37, 38, 50-54, 64-66, 69-71, 76, and 78 under 35 U.S.C. 103(a) as being unpatentable over Krogh and Foster et al., in view of Aoki. This rejection is respectfully traversed.**

<u>Claim 11</u>

Claim 11 is allowable over Krogh because Krogh does not teach, inter alia, "a computer controller system comprising program code capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level."

Krogh does not teach "a computer controller system capable of monitoring the signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level." Instead, Krogh is silent on the matter of a computer controller system.

Foster et al. also does not teach "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level." Instead, Foster et al. is also silent on the matter of any computer controller system.

Aoki also fails to teach "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, and determining whether the hazardous gas content of the effluent exceeds a safety level." Detecting conditions indicative of an endpoint and ending the etching process, as Aoki discloses, is different from a safety operational program code that detects when the hazardous gas content of the effluent exceeds a safety level.

Claim 26

Claim 26 is also allowable over Krogh because Krogh does not teach, inter alia, "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content of the effluent is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber."

The Examiner acknowledges that Krogh does not teach a computer controller system capable of performing at least one of the actions (i), (ii), or (iii) recited in claim 26. Krogh also does not teach a computer controller system capable of performing either of the actions (iv) or (v) recited in claim 26. Rather, Krogh makes no mention of any computer controller system.

Foster et al. also does not teach "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content of the effluent is determined to exceed the safety level, performing at least one of" the actions recited in claim 26. Rather, Foster et al. is also silent on the matter of any computer controller system.

Aoki fails to make up for the deficiencies of Krogh and Foster et al. because Aoki also does not teach "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content of the effluent is determined to exceed the safety level, performing at least one of" the actions recited above." Detecting conditions indicative of an endpoint and ending the etching process is not the same as program code that determines whether the hazardous gas content of the effluent exceeds a safety level, and performs one of the actions recited in claim 26 if the hazardous gas content of the effluent is determined to exceed a safety level.

Claim 28

Claim 28 is also allowable over Krogh because Krogh fails to teach a computer program product comprising computer readable program code, the computer readable program code comprising "safety operational program code that upon receiving a signal that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber." Instead, Krogh is silent on the matter of a computer program product.

Foster et al. does not make up for the deficiencies of Krogh because Foster et al. also fails to teach "safety operational program code that upon receiving a signal that the hazardous gas content of the effluent exceeds a safety level, performs at least one of" the operations recited above. Instead, Foster et al. is silent on the matter of a computer program product.

Aoki fails to make up for the deficiencies of Krogh and Foster et al. Instead, Aoki teaches substrate etching and a "control/computation unit 53 [that] ... outputs a control signal for ending the etching" at an endpoint. Detecting conditions indicative of an endpoint and ending the etching process is not the same as a safety operational program code that detects when the hazardous gas content of the effluent exceeds a safety level.

Thus, claims 11, 26, and 28, and the claims dependent therefrom, including claims 15, 27, 29, 30, 33, 37, 38, 50-54, 64-66, 69-71, 76, and 78, are allowable over Krogh and Foster et al., in view of Aoki.

**103(a) Rejection of Claims 2-5 and 57-59**

**The Examiner rejected claims 2-5 and 57-59 under 35 U.S.C. 103(a) as being unpatentable over Krogh in view of Foster et al. This rejection is respectfully traversed.**

Claims 2-5 and 57-59 are allowable over Krogh in view of Foster et al. because they are dependent on claims 1 and 24, respectively, which are allowable over Krogh and Foster et al. for the reasons presented above.

103(a) Rejection of Claims 41-43, 51, and 67-69

**The Examiner rejected claims 41-43, 51, and 67-69 under 35 U.S.C. 103(a) as being unpatentable over Aoki and Krogh, as applied to claims 10, 11, and 26. This rejection is respectfully traversed.**

Claims 41-43, 51, and 67-69 are allowable over Aoki in view of Krogh because they are dependent on claims 10, 11, and 26, which are allowable over Aoki and Krogh for the reasons presented above.

103(a) Rejection of Claims 8, 32, and 63

**The Examiner rejected claims 8, 32, and 63 under 35 U.S.C. 103(a) as being unpatentable over Krogh and Foster et al., as applied to claims 1 and 24, and further in view of U.S. Patent 4,816,046 to Maeba et al. This rejection is respectfully traversed.**

Claim 1

Claim 1 is allowable over Krogh and Foster et al. for the reasons presented above.

Claim 1 is further allowable over Maeba et al. because Maeba et al. fails to teach "an exhaust tube through which the effluent may be flowed, the exhaust tube being adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, and (ii) that cause turbulence in the flow of the effluent through the exhaust tube."

Instead, Maeba et al. teaches blocking the passage of the gas with an inner cylinder (7). (Col. 3, lines 45-56.) Moreover, Maeba et al. forms a pressure gradient between the inner cylinder (7) and an outer cylinder (6) such that the gas is preferentially drawn towards the inner cylinder and obstructed. (Col. 4, lines 6-29.) The

inner cylinder (7) is a projection that alters the flow direction of the gas, as shown in Figure 1.

Claim 24

Claim 24 is allowable over Krogh and Foster et al. for the reasons presented above.

Claim 24 is further allowable over Maeba et al. because Maeba et al. fails to teach "an exhaust tube through which the effluent may be flowed, the exhaust tube being substantially absent projections or recesses." The inner cylinder (7) of Maeba et al. is a projection that alters the flow direction of the gas, and Maeba et al. additionally forms a pressure gradient between the inner cylinder (7) and the outer cylinder (6) to draw the gas toward the inner cylinder obstruction.

Thus, claims 1 and 24 and the claims dependent therefrom, including claims 8, 32, and 63, are allowable over Krogh, Foster et al., and Maeba et al.

**103(a) Rejection of Claims 14, 34, 36, 48, and 73**

**The Examiner rejected claims 14, 34, 36, 48, and 73 under 35 U.S.C. 103(a) as being unpatentable over Aoki, Krogh, as applied to claims 10, 11, and 26, and further in view of Maeba et al. This rejection is respectfully traversed.**

Claims 10 and 11

Claims 10 and 11 are allowable over Aoki and Krogh for the reasons presented above.

Claims 10 and 11 are further allowable over Maeba et al. because Maeba et al. fails to teach "a computer controller system comprising program code capable of monitoring the signal from the gas analyzer" and "determining whether the hazardous gas content of the effluent exceeds a safety level."

Instead, Maeba et al. teaches a processor (21) that calculates the actual temperature difference between the inner and outer cylinders (7, 6). (Col. 6, lines 8-24.) The processor compares the actual temperature difference with a predetermined temperature difference, and feeds an output signal to a power controller 22 to eliminate the difference between the actual temperature difference and the predetermined temperature difference. A processor that monitors this temperature difference is different from a computer controller system capable of monitoring a signal from a gas analyzer and determining whether the hazardous gas content of the effluent exceeds a safety level.

Claim 26

Claim 26 is allowable over Aoki and Krogh for the reasons presented above.

Claim 26 is further allowable over Maeba et al. because Maeba et al. fails to teach "a computer controller system comprising program code capable of monitoring the output signal from the gas analyzer, determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content of the effluent is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber."

A processor that monitors a temperature difference, as disclosed in Maeba et al., is different from a computer controller system comprising program code capable of monitoring an output signal from a gas analyzer and performing one of the actions recited above when the hazardous gas content of an effluent exceeds a safety level.

**103(a) Rejection of Claims 47, 55, and 72**

**The Examiner rejected claims 47, 55, and 72 under 35 U.S.C. 103(a) as being unpatentable over Aoki in view of Krogh. This rejection is respectfully traversed.**

Claims 47, 55, and 72 are allowable over Aoki in view of Krogh for at least the reasons that claims 1, 11, and 26 are allowable over Aoki and Krogh, because claims 47, 55, and 72 are dependent on claims 1, 11, and 26, respectively. The reasons for the allowability of claims 1, 11, and 26 are presented above.

**103(a) Rejection of Claim 62**

**The Examiner rejected claim 62 under 35 U.S.C. 103(a) as being unpatentable over Krogh in view of Foster et al. This rejection is respectfully traversed.**

Claim 62 is allowable over Krogh in view of Foster et al. for at least the reasons that claim 24 is allowable over Krogh and Foster et al., because claim 62 is dependent on claim 24. The reasons for the allowability of claim 24 are presented above.

## CONCLUSION

For the foregoing reasons, allowance of the instant application is respectfully requested. Should the Examiner have any questions regarding the above amendments or remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES
A PROFESSIONAL CORPORATION

Date: March 5, 2003

By: [signature]
Reece Nienstadt
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**MARKED UP SPECIFICATION FOR APPL. NO. 09/055,201**

At page 9, lines 1-14:

The exhaust tube **85** preferably comprises an enclosed conduit through which a continuous stream of effluent flows as the effluent is energized by the gas energizer to abate the hazardous gas content of the effluent. The exhaust conduit **85** has an inlet that forms a gas tight seal with an exhaust port of the process chamber **25**, and an outlet that forms a gas tight seal with a vacuum pump **100**. In one embodiment, the inlet and outlet are substantially facing each other in an opposing relationship, as shown in Figure 2. The exhaust tube **85** is composed of gas impermeable material that has sufficient strength to withstand operating vacuum type pressures of $10^{-7}$ Torr. In addition, the exhaust tube **85** is made from material that is resistant to erosion from the energized effluent in the tube, and that withstands the high operating temperatures of conventional process chambers. The exhaust tube **85** should also have a transparent window that is transparent to the radiation coupled to the effluent, such as the microwave or RF radiation. The exhaust tube **85** can be composed of a ceramic material such as quartz (silicon dioxide) or polycrystalline aluminum oxide.

## PENDING CLAIMS (DELETE NON-AMENDED CLAIMS BEFORE SENDING)

## <u>MARKED UP CLAIMS FOR APPL. NO. 09/055,201</u>

1. (amended eight times) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to perform a process in the process chamber thereby forming effluent containing hazardous gas;

(d) an exhaust tube through which the effluent may be flowed, [the exhaust tube comprising sapphire and] the exhaust tube being adapted to provide a non-circuitous and non-turbulent flow of effluent therethrough by being substantially absent projections or recesses (i) that alter the flow direction of the effluent to provide a circuitous flow of effluent through the exhaust tube, and (ii) that cause turbulence in the flow of the effluent through the exhaust tube; and

(e) [a microwave] <u>an RF</u> energy applicator to couple [microwaves] <u>RF energy</u> to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent.

9. (once amended) The process chamber of claim 1 wherein the exhaust tube comprises [a distributor plate at] an inlet <u>and an outlet that are substantially facing each other in an opposing relationship</u> [of the exhaust tube].

10. (twice amended) A gas treatment apparatus for reducing a hazardous gas content of an effluent from a process chamber, the gas treatment apparatus comprising:

(a) an exhaust tube through which effluent from the process chamber may be flowed;

(b) [a microwave] an RF energy applicator to couple [microwaves] RF energy to the effluent flowing through the exhaust tube to reduce the hazardous gas content of the effluent;

(c) a gas analyzer capable of monitoring the hazardous gas content of the effluent and providing a signal in relation to the hazardous gas content of the effluent; and

(d) a computer controller system comprising [a computer readable medium having computer readable] program code [embodied therein, the computer controller system] capable of monitoring the signal from the gas analyzer, [and when] determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of the following:

(i) adjusting a power applied to the [microwave] RF energy applicator to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

11. (twice amended) A process chamber for processing a substrate and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate in the process chamber;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas; and

(d) an exhaust tube through which the effluent may be flowed;

(e) [a microwave] an RF energy applicator to couple [microwaves] RF energy to the effluent to energize the effluent;

(f) a gas analyzer capable of monitoring the hazardous gas content of the effluent in the exhaust tube and providing a signal in relation to the hazardous gas content of the effluent; and

(g) a computer controller system comprising [a computer readable medium having computer readable] program code [embodied therein, the computer controller system] capable of monitoring the signal from the gas analyzer, and [when] determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of the following:

(i) adjusting a power applied to the microwave energy applicator to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

14. (once amended) The process chamber of claim 11 [further comprising an] wherein the RF energy applicator is a microwave energy applicator to couple [RF] microwave energy to the effluent.

24. (amended three times) A process chamber for processing a substrate in a process gas and reducing emissions of hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate;

(b) a gas distributor capable of introducing process gas into the process chamber;

(c) a gas activator capable of activating the process gas to process the substrate thereby forming an effluent containing hazardous gas;

(d) an exhaust tube [comprising sapphire] through which the effluent may be flowed, the exhaust tube being substantially absent projections or recesses; and

(e) a microwave energy applicator adapted to couple microwaves to the effluent to reduce the hazardous gas content of the effluent.

26. (twice amended) A process chamber for processing a substrate in a process gas and reducing emissions of a hazardous gas to the environment, the process chamber comprising:

(a) a support capable of supporting the substrate, a gas distributor capable of introducing process gas into the process chamber, and a gas activator capable of activating the process gas to process the substrate, thereby forming an effluent containing hazardous gas;

(b) an exhaust tube capable of exhausting the effluent from the process chamber and a gas energizer adapted to energize the effluent in the exhaust tube to reduce a hazardous gas content of the effluent;

(c) a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and to provide a signal in relation to the hazardous gas content of the effluent; and

(d) a computer controller system comprising [a computer readable medium having computer readable] program code [embodied therein, the computer controller system] capable of monitoring the output signal from the gas analyzer, [and when] <u>determining whether</u> the hazardous gas content of the effluent exceeds a safety level, <u>and if the hazardous gas content of the effluent is determined to exceed the safety level,</u> performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent <u>without terminating the process</u>,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

27. (twice amended) The process chamber of claim 26 wherein the [computer readable] program code [on the computer readable medium] comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving an output signal <u>indicating</u> that the hazardous gas content of the energized effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

28. (twice amended) A computer program product for operating a gas treatment apparatus and process chamber, to reduce the hazardous gas content of an effluent formed during processing of a substrate in the process chamber,
the gas treatment apparatus comprising an exhaust tube capable of exhausting effluent from the process chamber, a gas energizer adapted to energize the effluent in the exhaust tube to reduce the hazardous gas content of the effluent, and a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and provide a signal in relation to the hazardous gas content of the effluent,
the computer program product comprising [a computer usable medium having] computer readable program code [embodied in the medium], the computer readable program code comprising:

(a) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes; and

(b) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

31. (once amended) The process chamber of claim 1 wherein the [microwave] RF energy applicator comprises a waveguide to couple [microwaves] RF energy to the effluent in the exhaust tube.

33. (once amended) The process chamber of claim [11] 14 wherein the microwave energy applicator comprises a waveguide to couple microwaves to the effluent in the exhaust tube.

34. (once amended) The process chamber of claim [14] 11 wherein the RF energy applicator comprises facing electrodes or an inductor coil.

35. (once amended) The process chamber of claim 24 wherein the [microwave] RF energy applicator comprises a waveguide to couple [microwaves] RF energy to the effluent in the exhaust tube.

37. (once amended) The process chamber of claim 1 further comprising:

(a) a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and to provide a signal in relation to the hazardous gas content of the effluent; and

(b) a computer controller system comprising [a computer readable medium having] computer readable program code [embodied therein, the computer controller system] capable of monitoring the signal from the gas analyzer, [and when] determining whether the hazardous gas content of the effluent exceeds a safety level, and if the hazardous gas content is determined to exceed the safety level, performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent without terminating the process,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

38. (once amended) The process chamber of claim 37 wherein the computer readable program code [on the computer readable medium] comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the energized effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

39. (once amended) The process chamber of claim [7] <u>1</u> wherein the [sapphire] <u>exhaust tube</u> comprises monocrystalline sapphire.

48. (once amended) The apparatus of claim 10 [further comprising an] <u>wherein the</u> RF energy applicator <u>is a microwave energy applicator</u> to couple [RF] <u>microwave</u> energy to the effluent.

49. (once amended) The apparatus of claim 10 wherein the [computer readable] program code [on the computer readable medium] comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving a signal <u>indicating</u> that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

54. (once amended) The process chamber of claim 11 wherein the computer readable program code [on the computer readable medium] comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving a signal indicating that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

62. (once amended) The process chamber of claim 24 wherein the [sapphire] exhaust tube comprises monocrystalline sapphire.

64. (once amended) The process chamber of claim 24 further comprising:

(a) a gas analyzer adapted to monitor the hazardous gas content of the effluent in the exhaust tube and to provide a signal in relation to the hazardous gas content of the effluent; and

(b) a computer controller system comprising [a computer readable medium having computer readable] program code [embodied therein, the computer controller system] capable of monitoring the signal from the gas analyzer, [and when] <u>determining whether</u> the hazardous gas content of the effluent exceeds a safety level, <u>and if the hazardous gas content is determined to exceed the safety level,</u> performing at least one of:

(i) adjusting a power applied to the gas energizer to reduce the hazardous gas content in the effluent,

(ii) adjusting process conditions in the process chamber to reduce the hazardous gas content in the effluent <u>without terminating the process</u>,

(iii) activating an alarm or metering display,

(iv) adding a reagent gas to the effluent before or after the effluent is energized, to reduce the hazardous gas content in the effluent, or

(v) terminating the process being conducted in the process chamber.

65. (once amended) The process chamber of claim 64 wherein the [computer readable] program code [on the computer readable medium] comprises one or more of:

(1) gas analyzer program code for receiving the signal from the gas analyzer, and storing or passing the signal to other program codes,

(2) gas energizer program code for adjusting a power level of the microwave applicator in relation to the signal,

(3) reagent gas program code for operating a reagent gas mixer that adds reagent gas to the effluent in relation to the signal, and

(4) safety operational program code that, upon receiving a signal <u>indicating</u> that the hazardous gas content of the effluent exceeds a safety level, performs at least one of (1) adjusting process conditions in the process chamber to reduce the hazardous gas content, (2) operating an alarm, (3) providing a metering display that shows the level of the hazardous gas content, or (4) shutting down the process chamber.

72. (once amended) The process chamber of claim 26 wherein the [sapphire] <u>exhaust tube</u> comprises monocrystalline sapphire.

73. (once amended) The process chamber of claim 26 [further comprising] <u>wherein the gas energizer comprises</u> an RF energy applicator to couple RF energy to the effluent.